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SPECIAL: DAIRY ISSUE

WE ALL LIKE MILK...

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State's dairy industry: bright future

Because of hard working, dedicated dairymen, the industry will continue to prosper'

Dr. James Martin, head of the Dairy Science department, has resigned effective February 1, to assume a similar position at Clemson University in South Carolina. During his 5½ years in South Dakota, he has become well known for his contributions to our state. We have invited him to share some of his thoughts about the dairy industry with you.

Ray Moore,
Director, South Dakota
Experiment Sation

This issue of Farm and Home Research contains a number of research articles about dairying. I am pleased to see this much emphasis given to dairying, because the dairy industry contributes significantly to the overall economy of South Dakota; and much research, teaching, and Extension work in dairying is carried out at SDSU.

Of course, all of us know that agriculture contributes the largest share of any industry to the economy of South Dakota. Milk and milk products comprise the fourth leading commodity in agricultural cash receipts in the state. The South Dakota dairy industry is alive and healthy!

The total number of dairy farms in South Dakota is approximately 5,000. Of these, 4,400 produce manufacturing grade milk, which is that milk used for cheese, butter, and powder, while 600 produce grade A milk, which is packaged and sold as fluid milk products such as whole, skim, and low fat milks, and as various cream products.

Many states have experienced decreased milk production during the past decade. However, South Dakota has maintained total milk production at about 1.6 billion lbs every year since 1965. Cow numbers have decreased from 226,000 in 1965 to 163,000 in 1977, but the annual production per cow increased from 6,990 lbs to more than 9,500 lbs, making up for the production that might have lost by the drop in cow numbers.

A very healthy growth rate has been evident in the South Dakota dairy industry during the past decade. In 1965, $46.7 million went into the pockets of dairy farmers as cash farm income from dairy products. In 1976, this value had increased to $127.5 million and was still growing in 1977. The value added by processing—which is that value added by conversion to cheese, butter, etc—amounted to approximately $25 million. So the total contribution of dairy products to the economy of South Dakota in 1976 was approximately $152.5 million dollars. At least $10 million also was paid to dairy farmers for cull cows and calves used for beef, which means that more than $160 million each year flows into the state's economy by way of the dairy industry.

As mentioned earlier, there are two grades, Grade A and manufacturing grade, of milk produced in South Dakota. In many states this is not the case because the

population is large enough to utilize all the milk in Grade A fluid products.

However, with our low population, about 78% of all milk produced in South Dakota goes into butter, cheese, and milk powder. To handle the manufacturing milk in South Dakota, there are 18 cheese plants, 11 butter plants, and 5 milk drying plants. Total volume of production in 1976 was 43 million lbs of dry milk, 10 million lbs of butter, and 65 million lbs of cheese.

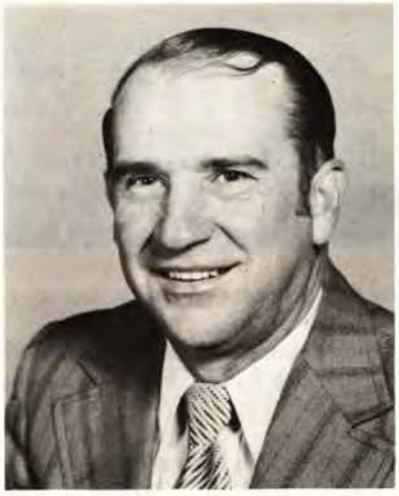
The major growth product during the past decade has been cheese. From 10.7 million lbs of cheese produced in 1960, the percent increase in cheese production has been more than 600%, to the 1976 figure of 65 million lbs.

Butter production has declined during those years until only about a fourth the amount of butter was produced in South Dakota in 1976 as in 1960. Dry milk production in the state has increased by approximately one-third during the same time period. South Dakota now ranks 5th in the nation in dry milk production, 9th in cheese production and 17th in the production of butter. So South Dakota is a very important dairy state from the standpoint of manufactured products.

With only about 700,000 people to consume fluid milk in South Dakota, that phase of the dairy industry certainly ranks lower than in the more populous states. However, there are currently eight fluid milk processing plants in the state, and these plants processed 312 million lbs of milk in 1976. The value of Grade A products sold was approximately $29 million, revealing that the fluid milk industry does contribute a significant portion of the overall income from dairying in South Dakota.

Realizing that I speak from a biased point of view, I believe that the Dairy Science Department at SDSU contributes a great deal to the overall success of the state's dairy industry. The department at South Dakota State has 12 full-time professional faculty members, 14 classified staff, 12 graduate students, and 90 undergraduate students. The undergraduate student population ranks among the top four or five departments in the country.

The students majoring in Dairy Manufacturing (approximately 60) comprise the largest number of



James H. Martin

manufacturing majors in any department in the United States or Canada. There also are two full-time Extension personnel and another faculty member who has a part-time Extension appointment. These Extension specialists provide programs in dairy cattle nutrition, physiology, reproduction, dairy herd improvement testing, sanitation, guidelines, mastitis prevention, and milking management, along with technical aspects of products processing and manufacturing.

What does the future hold for the South Dakota dairy industry? I have no crystal ball, but if I could look into the future I believe I would see a dairy industry which continues to grow and prosper. I say this mainly because of the people involved in South Dakota's dairy industry. During my 5½ years as Dairy Science department head, I have observed that South Dakota dairymen are ambitious, hard working, dedicated people. Dedicated people with a desire to get ahead are the necessary ingredient in any successful endeavor.

Two other ingredients are South Dakota's soil and climate. For instance, some of the very best alfalfa hay can be grown in South Dakota. In years when rainfall is plentiful, four cuttings of fine quality alfalfa can be harvested, and in most years with only minimal rainfall three cuttings are possible. Although South Dakota is not considered a corn belt state, it is on the corn belt's western fringe. And with normal rainfall and growing season, excellent corn silage can be produced, even though late summer droughts in many instances prohibit the harvesting of ear corn. Small grains for both forage and concentrates are fast becoming popular as dairy cattle feed, and small grain production has always been a mainstay in South Dakota agriculture.

With these ingredients—a favorable climate and terrain and strong-willed, dedicated people with an enthusiastic attitude toward dairying—I believe South Dakota's dairy industry will continue to grow and prosper in the years ahead. It is my sincere desire to see this happen.

□

Fermented colostrum

Whip storage problems by pickling the colostrum, then save up to $20 for each heifer calf fed

Dairymen until recently had to pour substantial amounts of a fresh cow's first milk, or colostrum, down the drain. But that's not necessary any more.

Calves need some colostrum, first drawn milk after birth, to survive. But after the new calf gets what it needs, the fresh Holstein cow may produce an extra 80 lbs of colostral milk that is not salable until after the first six milkings. Now, some dairymen are saving that formerly wasted milk for later feeding to calves.

Dr. L. D. Muller, former dairy scientist at SDSU and now at Pennsylvania State, has completed a 2-year study and found that producers might save about $15-$20 in feed costs per heifer calf by saving the extra colostrum and feeding it instead of whole milk. For a herd of 60-70 cows the potential savings can be substantial, according to Dr. Muller.

He studied colostrum saving not only because he thought it was a potentially wasted profit but because colostrum is very high in food value for calves. It is a rich source of protein, energy, vitamins, and minerals. Although colostrum composition changes rapidly after calving, the first six milkings are higher in nutrients than normal milk or reconstituted milk replacer (Table 1).

Table 1. Average composition of fermented colostrum and whole Holstein milk from several trials at SDSU.

Component	Colostrum	Milk
	%	
Total solids	16-17	12-13
Fat	5-6	3.6
Protein	5-6	3.5

But a big drawback to saving colostrum is storage.

"Freezing is probably best," says Dr. Muller. "SDSU researchers in 1972 found that calves fed thawed frozen colostrum gained 29% more weight during the first 3 weeks than those fed whole milk. But freezing the milk initially and then thawing it overnight before each feeding is inconvenient for most farmers."

"One of the most rapidly accepted dairy practices to come along . . . ."

That led Dr. Muller to follow suit of some English researchers who first fermented colostrum in 1971 as a way of storing it. This process, sometimes called souring or pickling colostrum, works much like making silage. When allowed to sit at the environmental temperature, milk simply ferments naturally. When it becomes acid, or reaches a pH of 4.5, it is preserved. This acidity is caused by the production of lactic acid which prevents the growth of harmful bacteria.

"Feeding fermented colostrum to calves has been one of the most rapidly accepted dairy practices to come along in recent years," Dr. Muller says. "A recent U.S. survey indicates that 28% of the dairymen are feeding it."

Dr. Muller used 150 Holstein calves during a 2-year study to further investigate the feeding value of fermented colostrum. For this study extra colostrum was collected from the first six milkings after calving. Then it was stored in 20-gallon garbage cans with plastic liners and allowed to ferment naturally at normal barn temperatures.

Dr. Muller explains some of the basic findings of this study:

Amount to feed. Calves should be fed at least 6 lbs of fermented colostrum, diluted three parts colostrum to one part water, for them to perform the same as calves fed whole milk.

This was the conclusion after feeding one group of calves 8 lbs of whole milk per day and another group fermented colostrum at 6 lbs per day diluted with 2 lbs of warm water (Table 2). A third group was given 4 lbs of fermented colostrum diluted with 4 pounds of warm water (Table 3). All calves were fed once a day for 4 weeks starting the third day of age.

Storage temperature. During the cooler months, fermented colostrum normally can be stored for 3 weeks or more before feeding. But during warm weather above 75° F, an undesirable fermentation occurs which causes calves to refuse colostrum.

Additives. In an attempt to find ways to preserve colostrum at temperatures above 75°, a series of laboratory studies was conducted to evaluate the effect of adding various organic acids and bacterial cultures.

Table 2. Calf performance during summer trial.

	Liquid diet			
		Colstrum		
	Milk	Naturally fermented	Propionic acid	Formaldehyde
Calves started	13	12	11	9
Calves finished	12	9	9	9
Calves refusing diet	0	1	1	0
Calf starter intake per day				
Week 0-4	.46	.62	.70	.40
Avg daily gain, lb				
Week 0-4	.55	.33	.46	.40
Week 0-10	1.17	.97	1.17	1.03
Total DM intake per lb gain				
Week 0-4	2.81	4.52	2.66	4.39
Week 0-10	2.34	3.34	2.38	3.11
Scours				
Calves treated	2	1	3	5
Total scour days	2	1	4	10

Calves weaned at 4 wk
Colostrum fed at 6 lb + 2 lb water

The most promising additives were formaldehyde and propionic and formic acids. Weight gains of calves were improved with additives as compared with those getting the naturally fermented colostrum. But gains still were less than those fed whole milk (Table 2).

Table 3. Calf performance during summer trial.

	Liquid diet		
		Colostrum	
	Milk	Naturally fermented	Culture
Calves	10	10	10
Avg daily gain, lb			
Week 0-4	.75	.33	.31
Week 0-10	1.14	.86	.86
Scours			
Calves treated	2	4	3
Total scour days	3	8	8

Calves weaned at 4 wk
Colostrum fed at 4 lb + 4 lb water

Storage length. Although a 3-week storage limit prior to feeding time had generally been accepted, no studies had previously compared length of storage on feeding value. So a trial was conducted in cool temperatures comparing 7-day versus 21-day storage on feeding value. No significant differences were noted in calf performance or colostrum acceptability (Table 4).

Feeding program and cost. If bull calves are not saved, the cost savings per calf was nearly $20 per calf, compared with those on whole milk. This allowed for expense of garbage cans and plastic liners.

If the bull calves are fed, this savings amounts to nearly $10 per calf. The savings would be less if milk replacer were compared. Also, if organic acids are added during the summer months, that would be another expense.

Table 4. Calf performance while testing storage length.

	Storage Length	
	Fresh (7 days)	Aged (21 days)
Calves	12	10
Calves refusing diet	0	1
Avg daily gain, lb		
Week 0-4	.36	.35
Week 0-10	1.04	1.26
Calf starter intake per day, lb		
Week 0-4	.52	.40
Scours		
Calves treated	3	4
Total scour days	3	5

Calves fed 6 lb colostrum and 2 lb water for 4 wk

Colostrum is nc substitute for good management

From this and other research Dr. Muller offers the following suggestions about feeding colostrum:

1. Feed about 5 lbs of the first colostrum within a few hours after birth directly to the newborn calf. Mix together all extra colostrum from the first six milkings.
2. Keep each cow's colostrum separate, or mix together with two or more cows' colostrum that have freshened at similar times.
3. Use a container with a plastic liner. Store in a cool place but not in the milk room.
4. Stir fermenting colostrum once a day just before feeding. This prevents separation.
5. Fermented colostrum can be held for at least 3 weeks before feeding during cool weather. Additives appear necessary during temperatures above 75°.
6. Feed at least 6 lbs of colostrum daily, depending on the size of the calf. Dilute two to three parts colostrum to one part warm water.
7. Feeding fermented colostrum is not a substitute for other good management practices. The real purpose for saving and feeding fermented colostrum is to reduce feed costs and still raise healthy calves, Dr. Muller says. □

Cafeteria choice

When cow is allowed to choose minerals she botches it, so force feed them in ration

We used to think that the dairy cow knew how to choose the kinds and amounts of minerals her body needed. But studies at SDSU and several other universities indicate she isn't that smart.

Research a long time ago gave the idea that a cow could select minerals to meet her needs. But more recent evidence shows she probably responds more to taste than need, according to Myers Owens, Extension dairyman at SDSU, and Larry Muller, dairy scientist formerly at SDSU and now at Pennsylvania State University.

Most of the kinds and amounts of minerals a dairy cow needs have been established for some time. Usually minerals are required in small amounts and must be fed at proper levels for high production and reproductive health. Too little or too much of a mineral can lead to health problems, and excessive consumption is a waste of a dairyman's money.

To insure that cattle get the right amounts, the dairyman can mix the proper amounts of minerals and vitamins in the cow's daily grain ration. (Table 1 shows the National Research Council's suggested mineral levels for lactating and dry cows.) Mixing is probably the best way for animals already getting a ration because it acts as a carrier for the minerals, Owens says.

But getting minerals to certain other cows isn't so easy. For example, dry cows usually don't get much grain, and some are fed high moisture grains directly from the silo. These animals often must be fed minerals free choice. Free choice feeding also may be necessary when the mineral content of a feedstuff is changed.

One development in feeding minerals free choice that has attracted attention is the "cafeteria style" mineral feeder which offers the animal a choice of 10 or more minerals in individual compartments.

Intake couldn't be predicted

Two short-term trials evaluating this style feeder were conducted by Owens and Muller. In the first, lasting 16 weeks, two groups of 10 Holstein cows each in mid-lactation were fed either corn silage or alfalfa hay as the sole forage plus grain rations to meet protein needs. No minerals or vitamins were force fed in the rations, so both groups needed some minerals from the cafeteria feeder.

Table 1. Suggested mineral levels for dairy cattle.

	Lactating cows	Dry cows
	% total ration DM	
Calcium	0.6 - 0.9	0.4 - 0.8
Phosphorus	0.4 - 0.5	0.3 - 0.4
Magnesium	0.2 - 0.3	0.1 - 0.2
Potassium	0.8 - 1.0	0.8 - 1.0
Salt	0.5	0.3
Sulfur	0.2	0.2

Corn silage and alfalfa differ greatly in mineral content. Corn silage is low in calcium, potassium, magnesium, and vitamins, compared to alfalfa hay. So the researchers expected the cattle on corn silage would consume more of those elements than the cows on alfalfa.

Intakes, measured weekly, didn't show that. For most minerals, intakes were highly variable from week to week (Table 2). Bentonite intake, for example, ranged from 2 to 169 grams per cow per day, based on weekly consumption.

More bentonite was consumed than any other mineral in both

Table 2. Mineral and vitamin intake from cafeteria mineral feeder (Trial 1).

	Ration	
	Corn silage	Alfalfa
	g/cow/day	
Bentonite	78.3 (2-169)	82.3 (30-134)
Calcium	9.8 (0-.84)	7.8 (0-.66)
Iodine	.05 (0-.35)	.01 (0-.09)
Magnesium	2.6 (0-7.3)	1.9 (.3-5.0)
Phosphorus	8.3 (2.1-15.9)	16.3 (9.0-24.4)
Potassium	14.6 (1.5-28.7)	0.4 (0-2.3)
Salt	8.4 (0-19.5)	5.2 (0-13.2)
Bicarbonate	6.6 (0-17.7)	6.9 (0-16.9)
Sulfur	2.4 (.8-7.5)	1.5 (0-2.9)
Trace minerals	1.9 (0-.9)	1.9 (0-5.0)
	units/cows/day	
Vitamin A	134,600 (0-450,000)	72,916 (7,600-258,000)
Vitamin D	67,348 (0-225,000)	36,458 (3,800-129,000)
Vitamin E	34 (0-62)	18 (2-64)

Values in parenthesis are daily intake ranges per cow based on weekly measurements.

Minnesota and South Dakota trials, but the need for bentonite by dairy cows is unknown.

The cows on silage did eat more potassium and vitamins, but not nearly enough calcium, magnesium, and trace minerals.

The higher free choice intake of phosphorus by the alfalfa groups was not anticipated, since they should have been getting enough from the grain and hay, Owens said. Cows fed the corn silage consumed more potassium, but they still didn't get enough. They ate phosphorus and magnesium in excessive amounts (Table 3).

Cows fed alfalfa consumed all four minerals far in excess of requirements.

Cows already on minerals wanted more

In another trial, two groups of 10 Holstein cows, each in late lactation, were fed corn silage and hay. Group one received minerals in the grain ration to meet requirements, while group two was not given supplemental minerals.

Both groups were offered minerals free choice from the cafeteria feeder. You'd expect that group two would consume more minerals.

Table 3. Summary of mineral intake from feed and mineral feeder (Trial 1).

	Ration	
	Corn silage	Alfalfa
	g/cow/day	
Calcium intake		
Feed	42.0	224.1
Mineral feeder	9.8	7.8
Total	51.8 (69%)	231.9 (339%)
Estimated requirements	75.1	68.4
Phosphorus intake		
Feed	51.1	54.9
Mineral feeder	8.3	16.3
Total	59.4 (104%)	71.2 (139%)
Estimated requirements	56.8	51.3
Magnesium intake		
Feed	50.9	66.9
Mineral feeder	2.6	1.9
Total	53.5 (134%)	68.8 (172%)
Estimated requirements	40.0	40.0
Potassium intake		
Feed	128.9	394.7
Mineral feeder	14.6	0.4
Total	143.5 (88%)	395.1 (242%)
Estimated requirements	163.0	163.0

Values in parenthesis are percentages of requirements consumed.

But as in the other trial, intakes were highly variable (Table 4). In general, group one cows, which were force fed minerals and vitamins and already getting enough to meet requirements, consumed more free choice minerals than group two.

Don't leave it up to the cows

Owens and Muller cite research at other universities that supports their conclusion that lactating dairy cows do not have the ability to select and consume a mineral based on need or requirement:

1. Cornell University conducted a 22-week trial offering daily free choice consumption to 69 lactating Holstein cows. Four rations meeting calcium and phosphorus requirements were fed. Despite this, 60% of the cows consumed some of the mineral supplement offered free

Table 4. Mineral and vitamin intake by cows from cafeteria mineral feeder (Trial 2).

	Force fed + free choice (group 1)		Free choice only (group 2)	
	g/cow/day			
Bentonite	80.0	(58-100)	84.3	(55-133)
Calcium	5.5	(0-23)	4.1	(0-18)
Iodine	.06	(0-17)	.09	(0-.23)
Magnesium	.39	(0-2.1)	.31	(0-1.4)
Phosphorus	4.4	(.6-8.4)	2.9	(0-11.7)
Potassium	1.2	(0-4.0)	1.2	(0-3.0)
Salt	28.5	(0-52)	23.4	(13-32)
Bicarbonate	27.0	(0-78)	8.3	(0-16)
Sulfur	4.3	(1.5-9.2)	2.8	(0-9.2)
Trace minerals	5.4	(0-16.2)	6.1	(0-12.9)
	units/cow/day			
Vitamin A	347,000	(17,000-750,000)	63,000	(35,000-107,000)
Vitamin D	173,500	(8,500-375,000)	31,500	(17,500- 53,000)
Vitamin E	87	(4-190)	15	(9-26)

Values in parentheses are daily intake ranges per cow based on weekly measurements.

choice. Variation in amount eaten by individual cows ranged from 0 to 2.2 pounds per day. Since all rations contained adequate amounts of calcium and phosphorus, the free choice option was an apparent waste.

2. Later Cornell conducted more experiments to determine if lactating cows deliberately fed diets deficient in calcium and/or phosphorus for 9 weeks would eat enough dicalcium phosphate to meet requirements in the next period when it was offered free choice. In each case, cows did not take enough free choice supplement to meet requirements and/or correct deficiencies.

3. University of Minnesota scientists compared consumption of minerals between cows having access to the cafeteria style feeder and cows offered dicalcium phosphate and trace mineral salt free choice. The forage and grain ration they received was calculated to provide enough minerals for cows producing 50 pounds of milk daily. No difference in milk production or reproductive performance was observed between groups. Mineral costs averaged 3.4 cents per cow per day for the cafeteria group, compared to 2 cents per cow per day for the control group. In a 50-cow herd this amounts to a wasted $22.50 per month.

Owens and Muller say that longer trials may be needed to more

critically evaluate the cafeteria mineral feeder and that more needs to be known about the storage of minerals and vitamins in the bodies of dairy cows.

But until then, they suggest dairymen force feed minerals and vitamins by a ration carrier when their systems and facilities permit. □

Miniaturized junipers

Small junipers are most popular, and SDSU research plots grow some 'dwarfs'

The genus *Juniperus*, which consists of cone-bearing evergreen shrubs or trees, is quite large (there are more than 50 species).

Most junipers withstand hot, dry conditions well, and certain ones actually grow in alkaline soil. Members of the genus are more adaptable than other evergreens to the Great Plains region because our climate is often hot and dry with severe winters and the soils tend to be slightly alkaline.

Junipers are available in many sizes, colors, and textures. They also vary in shape from completely prostrate, low-growing forms to spreading, globe-like pyramidal forms. Prostrate forms will be detailed in this article.

Many members of this genus have green leaves in just about every hue, along with golden, greenish-blue, blue-gray, and variegated forms. Some plants take on rich purple hues in winter months. Junipers often have thin, flaking bark with finely divided branchlets with two types of leaves. One leaf is the juvenile or needle-like leaf, and the other is the adult, scale-like leaf. In different species these two types may occur separately or on the same tree. Female plants form fleshy cone scales which unite to form a berry-like fruit containing one or more seeds.

The author is J. E. Klett, associate professor of ornamental horticulture.

Evaluation research of plant material adaptable to the Northern Great Plains climate, especially in the genus *Juniperus*, has been conducted by the SDSU Agricultural Experiment Station for many years. In McCrory Gardens at Brookings where the Horticulture-Forestry Department does woody ornamental research, some 70 different cultivars of *Juniperus* are under study, with new additions planted yearly. Several cultivars of creeping junipers in this collection are outstanding and have real merit for Great Plains landscapes. Ground cover junipers have multiple uses but are especially good for modern residential landscapes. Generally they are fairly maintenance free and give both good winter and summer color to any landscape situation.

Three cultivars of this genus with distinctive green foliage that have proven to be superior over a period

Juniperus communis 'Repanda'

of years include *Juniperus sabina* 'Arcadia' (Arcadia Juniper), *J. sabina* 'Broadmoor' (Broadmoor Juniper), and *J. sabina* 'Skandia' (Skandia Juniper). These three cultivars are selections from many thousands of seedlings grown from seed imported from Russia in 1933. The seed was imported from a USSR government forestry station near Petersburgh and collected from near the Ural Mountains. The seedlings were raised by the D. Hill Nursery Co., Dundee, Illinois. All three cultivars have shown resistance to juniper blight which attacks many cultivars of *J. sabina*.

Arcadia has a rich grass-green color, a spreading growth habit, and a somewhat ragged constitution. The leaves are almost entirely scale-like and are borne on strong, nearly horizontal branches. The green color persists through much of the winter with just the edges turning a slightly yellow-brown. It approaches 20 inches in height and has grown fairly rapidly. This cultivar has shown no appreciable winter dieback since planting in 1969.

Another excellent hardy juniper from this same Russian source is Broadmoor. This is often referred to as a more refined form of the popular Savin Juniper, 'Tamariscifolia.' This is the "dwarfest" form of these three Savin cultivars which have a spreading growth habit. The main branches are strong and grow horizontally with short, upturning branchlets. Seldom does the plant reach more than 12 inches in height, and it spreads fairly fast. It also maintains a fairly good green color into the winter months. It is hardy with no winter dieback problem and is one of the best green foliaged ground cover types in SDSU research trials.

Juniperus procumbens 'Nana'

The third cultivar selected from the numerous seedlings of the Russian exploration is Skandia, which is extremely hardy. It has a mid-green foliage color, maintained throughout the year. This cultivar has a flatter growing habit than that of Arcadia but is not as prostrate as Broadmoor. It is very dense. The foliage has a slightly yellow tinge in the winter at Brookings. It makes excellent ground cover and withstands adverse climatic conditions quite well.

Juniperus sabina 'Skandia'

Juniperus horizontalis is a species in which numerous cultivars have been selected and named. In SDSU trials all cultivars of this species are prostrate. Branches of this species are long; branchlets are numerous and short but dense. Three cultivars have proven to be exceptional under South Dakota's hot and dry growing conditions. These are 'Glauca' (Blue Creeping Juniper), 'Blue Rug' or 'Wiltoni' (Blue Rug Juniper), and 'Plumosa' (Andorra Juniper).

The Glauca cultivar is a completely prostrate variant of this species. It lays its foliage flat on the ground and forms a mat with long, straight main branches. Since planting in 1970 it has built up some height, but generally it is less than 6 inches high. The main branches on Glauca are sturdier and straighter running than other *J. horizontalis* discussed here. Leaves are mostly scale-like and very densely appressed, giving it a "whip-cord" effect. Occasionally a few juvenile leaves are present in the center of the plant. The foliage color is an outstanding blue, turning to bluish-gray in winter.

Blue Rug or Wiltoni is similar in many respects to Glauca, except that Blue Rug is a slightly slower grower and has a more prostrate growth habit. This cultivar has excellent silvery blue foliage during the growing season and is grayish-blue during the winter. It is neat appearing and makes an excellent ground cover plant or rock garden

gem. Foliage and stems of Blue Rug are a little finer textured than Glauca. This, along with its more prostrate growth habit, make it one of the best cultivars in the SDSU collection. It is less than 6 inches in height and develops fruit fairly early, which adds to its other excellent ornamental characteristics.

Another cultivar of *J. horizontalis* which doesn't run true to the typical growth habit of the species is Plumosa or Andorra Juniper. This plant builds itself up into a low, many branched shrub which can reach 15-20 inches in height. The branches of Andorra Juniper are upward facing at about 45 degrees and bear awl-like foliage loosely appressed and arranged plume-like. Andorra Juniper is a vigorous grower. It has bluish-gray-green foliage during the growing season, turning to a distinct purplish color in winter. This plant is used extensively in foundation plantings, since it adds unique winter color in the Great Plains. Occasionally some dieback is observed, since it seems a little less hardy than the previously described cultivars of *J. horizontalis*.

The juniper species *communis* is quite variable in growth habit. Many are upright and tree-like; others are superior prostrate cultivars, especially one called *J. communis* 'Repanda' (Creeping common Juniper). This is a very vigorous, dense grower, a characteristic useful for a ground cover. This plant is very soft to the touch without the prickliness associated with some *J. communis* cultivars. The leaves are awl-shaped and grow straight out at an angle from the stem in whorls of three. They are quite small, giving the plant a very neat appearance. The branches are quite flexible and brown in color. The leading shoots send out their laterals in regular flat sprays. The upcurved foliage is mid-green with a well defined broad stomatic line on the upper side. This cultivar exhibits a low mound growth habit and is generally less than 10 inches in height. The foliage turns a slight yellow-green in more exposed areas in the winter but not enough to be of concern.

Another superior ground cover juniper in SDSU trials is *Juniperus procumbens* 'Nana' (Dwarf Japanese Juniper). This is a very prostrate species which eventually covers a large area. Main branches are quite stiff and stout, and the growing tips tend to turn upward. Leaves are formed in threes and are linear with sharp points. Two glacous bands develop on the underside of the needle. Trial plants have become quite dense and are less than a foot high. Foliage is blue-green, changing to a bluish-gray in the winter. This cultivar is a more desirable landscape plant than the straight species and is particularly useful as a ground cover for rock garden areas. New growth is bright green, which later turns to the typical blue-green. Both Nana and the straight *J. procumbens* are planted side by side in the SDSU trials. Nana is the superior plant in nearly every way.

These eight cultivars are examples of superior ground cover junipers which have been exceptional in SDSU experimental plots during the past 10 years. Each has many outstanding ornamental characteristics and are both hardy and adaptable. The low growth habit makes them well suited for use as ground cover plants for contemporary maintenance-free landscaping. By planting juniper ground covers, homeowners can enjoy them throughout all seasons of the year, making for a more liveable environment throughout the Great Plains area. □

Juniperus horizontalis 'Glauca'

Dicamba drift

Farmers report few drift incidents, and will keep using dicamba, but soybeans are supersensitive

You planted soybeans in the field next to your corn. And thistles came up in the corn.

So you moved into the corn with dicamba. Chances were, unless it was a completely calm day, some of the herbicide drifted into the soybeans.

Soybeans are extremely sensitive to dicamba. But you'll have a hard time pinpointing any effects on yield. It's hard to identify the causative agent in any herbicide drift injury case. The possibility also exists that there are differences in tolerance between varieties and in growth stage susceptibilities.

Residue analysis may aid in identifying the herbicide that caused drift injury. The half life of dicamba is about 2 weeks in grasses. However, dicamba metabolism occurs slowly in sensitive weeds, so residue analysis may be possible in soybeans.

Degree of injury varied with growth stage

Our research has shown that visual injury symptoms do not necessarily indicate yield reduction, because soybeans in different growth stages vary in tolerance to dicamba.

We've also found that yield reduction can be minimized if dicamba is applied before soybeans are blooming in the area. This is a recommendation of SDSU included in the precautions given for the dicamba treatment for weed control in corn.

All dicamba treatments on the beans in our experiments caused visual injury such as cupped leaves, bent stems, grayish leaf margins, and maturity delay.

Leaf and stem injury appeared 1 to 14 days after dicamba application and persisted throughout the season. Higher rates of dicamba caused more severe visual injury than lower rates. Dicamba produced similar leaf and stem injury at all application stages, but the greatest amount of maturity delay occurred from application at mid-bloom and thereafter.

Plant height was not reduced by dicamba application at the 1- to 2-trifoliate or late pod stages. Early bloom stage applications caused the greatest height reductions. In 1976, the average height of soybeans treated at the early bloom stage was 17 inches compared to 24 inches with late pod stage application.

This growth response to dicamba can probably be explained by its movement to the meristemic (growing) regions. From the beginning of flowering to the beginning of podfill the greatest number of meristemic regions are producing dry matter in the form of leaves, petioles, and stems. Therefore, at early bloom stage growth inhibition caused by dicamba has the greatest effect on plant height.

As with height, dicamba application at the early bloom stage caused the greatest yield reduction, indicating greater soybean sensitivity at the early bloom stage. In 1975, the 0.01 lb/A rate reduced yield at the early bloom stage but not at the early pod stage. Dicamba application before the early bloom stage and after the early pod stage did not significantly reduce yield.

Dicamba application before podfill did not reduce germination of seed from injured plants. However, in 1975 the 0.05 lb/A rate applied at the early pod stages reduced seed germination and seedling emergence. The 0.01 lb/A rate of dicamba applied at the early pod stage may have delayed emergence, because emergence counts taken 9 and 15 days after planting were different. Leaf abnormalities or reduced vigor were not noted in progeny of injured soybeans.

In 1976, applications made at podfill stage reduced germination, but late pod stage applications

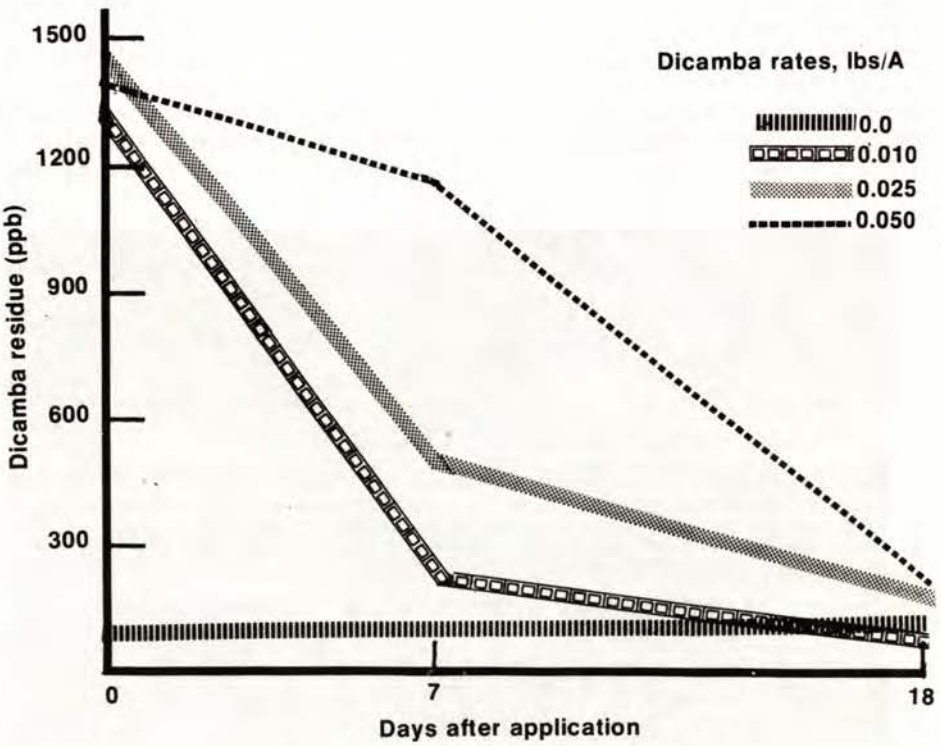


Figure 1. Dicamba residue in soybean foliage 0, 7, and 18 days after application.

The authors are Gene Arnold and Duane Auch, Plant Science Department.

caused the greatest reductions in germination. Dicamba accumulation in the seed may have caused the reduction in germination when dicamba was applied at pod filling.

Some varieties are affected less

We found significant yield reductions from dicamba application in all varieties except Wells, SRF-200, and Woodworth.

Tolerance is probably due to factors other than variety maturity since yield was reduced in varieties of similar nature.

Even though yield losses varied, dicamba caused equal amounts of leaf and stem injury on all varieties except SRF-100. This again illustrates that visible injury does not necessarily mean a consequent yield loss.

The final dicamba application did not reduce height of early maturing varieties. At that date these varieties were in a more tolerant growth stage than at earlier applications.

Dicamba delayed maturity of all varieties, but varietal differences in response appear to exist. SRF-150 was not delayed in maturity by the first two dicamba applications, but varieties in the same maturity group were.

Residue is detectable

Dicamba in soybean foliage could be detected by residue analysis.

The amount detected was significantly influenced by the amount of dicamba applied and by the amount of time between application and sampling. One week after dicamba application the residue levels were less than levels immediately after application for all application rates, but the reduction was greater with the two lower rates (Fig 1). Dicamba residue levels became undetectable between 7 and 18 days after application.

These results do not necessarily indicate dicamba breakdown, because dicamba metabolism is slow in sensitive plants. The reduction in dicamba residue levels may be due to dilution by plant growth.

No significant residue levels were detected in the seed of plants treated at early bloom. This seed also germinated normally.

Farmers feel benefits outweigh the risks

Farmers are alert to the fact that given the right circumstances, dicamba drift can harm their soybeans. But when broadleaved weeds are threatening corn yields, they are apparently willing to take the chance, according to a telephone survey of 159 farmers in South Dakota's major soybean growing area.

Table 1. Dicamba users, acres per user, and acres of corn, small grain, and pasture treated with dicamba in 1976 by farmers surveyed in Clay, Lincoln, Turner, and Union counties of South Dakota.

Crop	Counties				Total per crop
	Clay	Lincoln	Turner	Union	
Corn					
Acres treated	966	2609	761	667	5003
Number of users	7	17	10	12	46
Acres per user	138	153	76	56	109
Small grain					
Acres treated	650	0	69	54	773
Number of users	2	0	1	1	4
Acres per user	325	0	69	54	193
Pasture					
Acres treated	69	89	25	47	230
Number of users	2	3	1	3	9
Acres per user	34	30	25	16	26
Total acres treated	1685	2698	855	768	6006
Total acres per user*					120

* Average of 50 users surveyed. Some farmers used dicamba on more than one crop.

Approximately 20% of the corn was treated with dicamba mainly to control Canada thistle. Greater tolerance of corn to dicamba than 2,4-D encourages the choice of dicamba.

Most of the dicamba was applied by farmers. Only three of the dicamba users hired commercial applicators, and two of these applied some additional dicamba themselves. Only six of the 50 dicamba users had not applied dicamba before 1976, indicating that most users were experienced in using this herbicide.

Dicamba drift incidents appeared to be few and minor in 1976. Six of 10 drift cases involved the dicamba users' own soybeans. In one case commercial application resulted in injury to a neighbor's soybeans. Three soybean growers reported dicamba drift injury from applications made by nearby farmers. Dicamba affected less than 10 acres of soybeans in all but two cases.

Only one farmer thought yield was reduced, and he estimated the reduction at less than 10%. In this case injury occurred when soybeans were in the bloom stage, the most sensitive to dicamba. In eight other cases, drift occurred before the soybeans were blooming; therefore effect on yield was negligible.

About the same amount of dicamba was used in 1977 as in 1976, according to this survey.

Of the 159 farmers surveyed, 41 indicated they would use dicamba in 1977 while 35 farmers were undecided. Three farmers planned to use dicamba for the first time. Only one farmer who used dicamba in 1976 did not plan to use it the next year. The 41 farmers who planned to use dicamba in 1977 indicated that they would treat 5,400 acres. This is an average of 130 acres per farmer—slightly higher than the 1976 average of 120 acres. The small difference between 1976 use and that planned for 1977 is an indication farmers presently using dicamba feel the benefits of use outweigh the risks of drift. □

Shrubs for modern landscaping

Smaller shrubs are winning favor; check the outstanding examples at McCrory Gardens

Climatic conditions of the Northern Great Plains present a real challenge for growing certain woody ornamentals. With homeowners showing an increased interest in home and public beautification, it is more important to select woody ornamentals for growth rate and habit, winter hardiness, foliage appearance, duration of flower, fruit color, and size. The contemporary homes of millions of Americans also call for shrubs which are generally low in height and fairly maintenance free. Modern homeowners desire some additional ornamental features such as attractive flowers or fruits.

Evaluation research which results in a greater variety of plant material adaptable to climatic conditions of the Northern Great Plains has been done for many years at various state universities and in other experimental plots in the area. At SDSU, research has been conducted by the Horticulture-Forestry Department in McCrory Gardens to evaluate deciduous ornamental shrubs for adaptability to the area and for various ornamental characteristics. These trials have shown numerous deciduous shrubs to be outstanding for this area.

Several shrubs in SDSU research plots have emerged as outstanding basically because of smaller growth habit. Plants which fall into this category include *Cotoneaster congesta* (Pyrenees Cotoneaster), *Caragana brevifolia* (Shortleaf Peashrub), *Caragana frutex* 'Globosa' (Globe Caragana), *Lonicera xylosteum* 'Emerald Mound' (Emerald Mound Honeysuckle), and for a corner planting *Rhamnus frangula* 'Columnaris' (Columnar Buckthorn).

Cotoneaster congesta is very low growing, attaining a height of less than one foot, with a dense, compact growth habit. It has been in trials at Brookings since 1969 and appears quite adapted to the Northern Plains once it is established. It has small, dark, glossy green leaves with wavy margins. The small flowers are inconspicuous, but the fairly abundant red fruit add effective color in the fall. It is definitely the most superior cotoneaster in the trials for uniform growth habit and good fruit characteristics. It would definitely fit well into foundation plantings where a ground cover effect is desired.

Peashrubs are deciduous shrubs generally used because of their yellow flower or growth habit. This genus is quite hardy, and various species are planted throughout the Great Plains. Two species in SDSU trials have a superior growth habit. *Caragana frutex* 'Globosa' has a pronounced globe-rounded shape which is maintained to maturity. The plant needs very little pruning, if any, to maintain this globe shape. It has no attractive flowers or fruit, but it does have good dark green foliage which generally holds late into the fall. It is hardy, never showing winter damage in SDSU trials. It would be ideal for a foundation planting, or it could be planted as a low maintenance hedge plant.

Caragana brevifolia is another superior peashrub with a very fine textured, arching growth habit. It is extremely hardy. Although it has no ornamental flower or fruit, it does have fairly good dark green foliage. The arching growth habit adds some character to the shrub which could be used to advantage in any contemporary foundation planting.

Lonicera xylosteum 'Emerald Mound' is a cultivar of the European Fly Honeysuckle which has a compact, mounded growth habit. It has good dark green leaves throughout the summer that turn yellow-purple in the fall. It does not have flowers or fruits of ornamental value. It has been in SDSU trials since 1971 and is superior to the cultivar "Claveyi' in growth habit. The plant has never shown any

Potentilla fruticosa 'Coronation Triumph'

The author is J. E. Klett, associate professor of ornamental horticulture.

winter damage. It would be suitable for a low hedge and for foundation plantings.

A plant with a narrow upright growth habit which could be used nicely as a corner plant in a foundation planting is *Rhamnus frangula* 'Columnaris.' This plant also can be used as a compact, narrow hedge with little or no maintenance pruning required. It fares well during Great Plains winters, although minor dieback has been observed in some springs. Leaves are dark, glossy green during the summer, changing to greenish-yellow in the fall. Flowers are unimportant, but the fruit changes from red to purple-black during the maturation process through September. The plant should be grown in full sun to maintain its dense form.

Besides outstanding growth habit and generally carefree maintenance practices, most homeowners desire additional ornamental characteristics of flower or fruit, or both, on deciduous shrubs planted around their homes. Various shrubs in SDSU trials have continually shown these outstanding ornamental characteristics but still maintain growth habits suitable for foundation plantings. *Abeliophyllum distichum* (Korean Abelialeaf) and *Potentilla fruticosa* 'Coronation Triumph' (Coronation Triumph Cinquefoil) have outstanding flowers; whereas *Ilex verticillata* (Winterberry) and *Lonicera tatarica* 'Valencia' (Valencia Honeysuckle) have good fruit characteristics. *Viburnum opulus* 'Compactum' (Compact European Cranberrybush) and *Cornus alternifolia* (Pagoda Dogwood) have outstanding flower and fruit characteristics.

Caragana frutex 'Globosa'

Rhamnus frangula 'Columnaris'

Since most species of the genus *Forsythia* which are grown for their early spring flower color are not dependably winter hardy in the Northern Great Plains, *Abeliophyllum distichum* can be planted as a substitute. It has been in SDSU trials since 1967, and has bloomed early each spring with numerous white flowers. Leaves are dark green throughout the summer, turning to a purplish fall color. Growth habit is a little more open than desired, but the early white flowers announcing the coming of spring make it desirable for planting in the Great Plains.

A genus of small and often scraggly appearing shrubs are the Potentillas. Potentillas are adapted to adverse conditions and perform well in droughty areas and do best in full sun. Numerous cultivars have been introduced, and have been planted in SDSU trials. *Potentilla fruticosa* 'Coronation Triumph' has been outstanding over the past years due to its prolific golden yellow flowering from summer to fall. This cultivar has a more upright growth habit and matures at about 3-4 feet. Leaves are of fine texture and have a better green color than most cultivars. Fruits are small, dry, hairy capsules which are persistent but have no ornamental value. The plant can be used in foundation plantings for its attractive flower and small growth habit.

Ilex verticillata is adapted to the more rigorous growing climate of the Plains. Occasionally chlorosis on the leaves occurs due to alkaline soil. This shrub has been planted at Brookings trials since 1970 and has never shown any winter damage. It is a slow grower, oval in shape, with fine, twiggy branches. The fruit, which is shiny bright red, is generally effective from September to January. It is excellent for mass effect. Male and female are required for fruit set.

Most honeysuckles become quite large with age and are not suitable for foundation plantings. *Lonicera tatarica* 'Valencia' is a cultivar which is more compact in growth habit than most cultivars of Tatarian Honeysuckle. It has the upright-arching growth habit of the species but it is more compact. The foliage is bluish-green in summer and bears pink to white flowers in June. The numerous, orange fruits persist into the winter. It fruits a little later than most honeysuckles, but the fruit is of high quality. Due to its more compact growth habit it could be used effectively in larger foundation plantings.

Several shrubs outstanding in trials at Brookings in both flower and fruit characteristics include *Viburnum opulus* 'Compactum' and *Cornus alternifolia*. Compactum has been evaluated for 1-10 years and has maintained an excellent rounded globe growth habit of 4 or 5-feet without any maintenance. The compact European Cranberry has white flowers borne in flat cymes in late May and June. The flowers are of interest because the sterile and fertile flowers in the inflorescence create a pinwheel effect. The fruit is a deep red color which starts in July and persists into the winter. Fruit on this shrub has been abundant since its original planting. This cultivar doesn't seem to be as infested with aphids as the species. This plant would be excellent in masses or as a specimen plant.

Where horizontal accents are needed in a landscape, the somewhat larger shrub *Cornus alternifolia* can be used. This plant has been evaluated since 1969 and appears adapted to the Great Plains if a northern seed source is used. The yellowish-white flowers borne in flat-topped, upright cymes are effective for about 2 weeks in early June. The non-persistent fruit is bluish-black in color in August, but the persistent fruit stalk does turn to a pinkish-red. *C. alternifolia* could be the Great Plains Region substitute for *C. florida*.

Numerous deciduous shrubs have shown outstanding summer or winter texture characteristics. *Cornus stolonifera* 'Isanti' (Isanti Redosier Dogwood) is a hardy shrub with outstanding red to purplish-red twig color which is very handsome and eye appealing in a winter setting against snow. This cultivar has been planted in SDSU trials since 1970 and has a dwarf, mounded growth habit. Flowers are a dull white borne in a flat-topped cyme in early June. Fruit is white, borne in late August-September. Foliage is fairly clean and is apparently more disease and insect resistant than the species. Another shrub with an outstanding ornamental characteristic is *Rosa rubrifolia* (Redleaf Rose). This shrub is mostly non-suckering and has attractive red-blue foliage throughout the growing season. The flower is single, rather small, and bright pink. Fruit is maroon in color and persists, adding some winter color. Foliar diseases are not common, making it desirable for contemporary residential foundation plantings.

These 13 plants are examples of deciduous shrubs which have proven to be outstanding in research plots at SDSU over the past 10 years. Each shrub has one or more outstanding ornamental characteristics that are well suited for planting in most contemporary foundation plantings.

These shrubs mean less maintenance work for homeowners, and as foundation plantings they have excellent ornamental effect. □

Ilex verticillata

Low-cost protein

If you can get cheap sunflower meal, feed it; cows won't know the difference

Dairymen may want to choose a new protein supplement for feeding dairy cows when the price is right. The new source—sunflower meal.

"Dairymen who can get sunflower meal at a lower cost per pound of protein than another protein source might want to consider feeding it to milking cows." says D. J. Schingoethe, SDSU dairy scientist. He makes this statement after comparing soybean oil meal and sunflower meal fed to dairy cattle.

Sunflower meal offers cattle a good quality protein, and a dairyman generally should let price determine if he should switch to it, according to the researcher. Sunflower meal contains 36-38% protein, slightly less protein per pound than soybean oil meal. So when comparing costs, figure that 1.2 lbs of sunflower meal contain about the same amount of protein as a pound of soybean meal.

Though sunflower meal has been fed to other livestock, especially in other countries, for some time, little research had been done examining its feed value for ruminants. Previous SDSU studies showed that sunflower meal can replace soybean meal as the protein supplement in calf starters. Now, Schingoethe has carried the former research a step further with lactating dairy cows.

The author is Jacqueline Ullery, Ag Information Office.

The source is close at hand

His work was spurred by growing attention toward sunflower production in South Dakota. The crop has some drought resistant qualities attractive to growers in the state. Sunflower meal, like soybean meal, is a byproduct of the vegetable oil industry. But the two differ. Sunflower seeds from the oil seed varieties contain 45-50% oil, or more than twice the oil content of soybeans.

For feeding dairy cows, the biggest difference between soybean meal and sunflower meal shows in the crude fiber content. Sunflower meal contains 13-15%, while soybean meal has 6%.

To find out if this had meaning in the digestive tract of the milking cow, Schingoethe essentially compared the results of feeding sunflower meal with soybean meal, a wellknown and well used protein source for cows.

This is what he did: Two concentrate rations were formulated. Each contained 60% of the needed crude protein either from soybean meal or from sunflower meal. To balance the ration, more oats and less corn were needed in the sunflower ration (Table 1). So together with the additional oats and the higher fiber content of the sunflower meal, the sunflower meal ration contained about twice as much fiber as the soybean ration.

Twenty milking Holstein cows were paired on the basis of production, age, and stage of lactation. One cow from each pair was assigned randomly to each of the two concentrate mixes (Table 1). The mixes were group-fed at one pound of mix per 3 lbs of milk produced throughout the 16-week trial. Corn silage was group-fed free choice, and alfalfa brome hay was fed at about 5 lbs per head daily. Each group of cattle was housed in a free stall barn.

Table 1. Ingredients in soybean meal and sunflower meal concentrate mixes[1].

Ingredient	Ration	
	Soybean meal	Sunflower meal
	(%)	
Ground shelled corn	48.5	11.5
Rolled oats	27.5	55.6
Soybean meal, 50% cp	22.0	—
Sunflower meal, 37% cp[2]	—	30.9
Dicalcium phosphate	1.0	1.0
Trace mineralized salt	1.0	1.0

[1]Rations also contained 2,000 IU added vitamin A and 300 IU added vitamin D/lb.
[2] Solvent processed, Cargill, Inc., Minneapolis, MN. Analysis: (90% dry matter) crude protein, 37.0%; acid-detergent fiber, 21.2%; ether extract, 2.0%; ash, 5.9%.

Performance was the same

Basically, the results were the same from both groups. Milk yield and composition was very much alike. Feed consumption and weight gain was the same for both (Table 2). Of special significance was that no palatability problems were experienced with the sunflower meal ration, in contrast to previous experiments in Florida with beef cattle. A former SDSU study with sunflower meal fed in calf starter showed calves ate it readily.

Table 2. Milk yield and composition, feed intake, and body weight gain of cows fed soybean meal and sunflower meal rations.

	Ration	
	Soybean meal	Sunflower meal
Milk yield (lb/day)		
Actual	46.7	46.4
Fat-corrected	45.7	45.1
Solids-corrected	45.6	45.1
Milk composition (%)		
Fat	3.96	3.87
Protein	3.44	3.44
Total solids	12.80	12.75
Solids-not-fat	8.85	8.89
Feed intake* (lb DM/day)		
Concentrate	14.4	14.6
Hay	5.3	5.4
Corn silage	19.6	19.5
Initial body wt (lb)	1,428	1,352
Body wt gain (lb/day)	0.95	0.97

* Based on group feed intake.

Samples of rumen contents were taken from the cows twice during the experiment to evaluate the effects of sunflower meal on fermentation of feeds while in the cow's stomach. The researcher found that grain and forage consumed by the cow were digested in the same manner whether the protein supplement fed was soybean meal or sunflower meal. The rumen contents from animals on sunflower meal were slightly more acid, which may be caused by faster digestion of the sunflower meal.

Schingoethe says that dairymen may need to limit the amount of sunflower meal used in rations for milking cows getting all grass or poor forage, since the fiber content of sunflower meal is high. But feeding sunflower meal to cattle on high corn or all corn silage could offer a real money saving advantage. □

A check on antibiotics

Avoid treating dry cows for mastitis just before calving

Dairy cow mastitis treatments have proven safe and effective when dairymen follow manufacturers' instructions. But when cows calve unexpectedly early, is the milk protected from antibiotic residue?

With more and more dairymen using dry cow treatments, we decided to check on the amount of time antibiotics stay in the dry udder, using two of the common antibiotics—penicillin and cloxacillin.

Directions on the label for penicillin say: do not use during the 6 weeks prior to calving, and then after calving withhold milk from the market supply for 96 hours. For cloxacillin, directions read: do not use this preparation during the 4 weeks before calving and withhold milk for 72 hours after calving.

To see what happens when cows are treated closer to calving, we treated 19 Holstein cows by intramammary infusion of two quarters 10-12 days before the expected calving date.

The two quarters not treated with an antibiotic were given distilled, sterile water. This was to determine if antibiotics would cross over from treated to non-treated quarters.

After each cow calved, milk samples from all four quarters were collected in sterile bottles at 12-hour intervals up to 5 days. The milk samples were tested for antibiotics by using the *Sarcina lutea* cylinder plate method, which is the procedure commonly used by dairy plants and regulatory labs for checking farm bulk tank milk samples for antibiotics.

Cloxacillin was detected in milk from two of the eight cows and then for only the first milking. Thus, all of the cloxacillin was cleared out of the udder well within the 72-hour withholding period suggested by the manufacturer.

Penicillin residues were observed in the milk from seven of the 11 cows treated. No penicillin residues were detected in milk samples from cows treated more than 9 days before calving. All but two cows that were treated with penicillin less than 9 days before calving had detectable penicillin residue in the milk from treated quarters after calving.

Antibiotic crossover from treated to non-treated quarters occurred only in one cow, and this penicillin-treated cow calved within 24 hours after treatment. Since treatment occurred so soon before calving her treatment probably should be considered the same as for a lactating cow.

This emphasizes the importance of avoiding treatment of dry cows just before calving, to ensure that no antibiotic is carried over into the milk.

With the exception of the cow that was treated a day before calving, all the milk samples from cows treated with either of the two preparations showed no detectable antibiotic residue beyond the manufacturer's recommended period for withholding milk from the market supply.

Though more research needs to be done with more cows this study points out the need for dairymen to follow directions completely with dry cow mastitis treatments. Keep milk out of the market supply for the specified days. When a cow calves within 10 days after infusion of a dry cow antibiotic, milk should be checked for antibiotic residue before putting it on the market. □

The authors are J. H. Martin, M. E. Johnson, R. J. Baker, and J. G. Parsons, Dairy Science Department

Publications Off the Press

The Agricultural Experiment Station and the Cooperative Extension Service distribute a large variety of publications to South Dakota citizens. Your county Extension office will have copies for you. These publications list the new subjects between September 1 and November 30, 1977.

FS 501 One-Way Disc Plow (rev)
FS 653 Your Well Records
FS 670 Irrigation Management on Corn
FS 673 Weatherstripping and Caulking to Save Energy
FS 674 Zinc Deficiencies
FS 675 Health Risks of Forage Handling
FS 540 Dare to Decorate (rev)
FS 519 Stain Removal (rev)
FS 579 Measuring Forage and Grain in Storage
EMC 666 Livestock Budgets and Planning Prices for 10 Steps Planning (rev)
B 650 Local Public Finance Impacts of Rural Residential Development (rev)
C 218 Achieving More Freedom to Farm through Tenancy Improvement

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